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Research Report 1937

THE RETENTION OF DIGITAL SKILLS: COMMAND POST OF THE FUTURE

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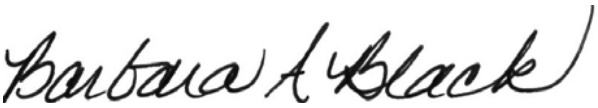

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The new generation of Army command-post digital systems, e.g., Command Post of the Future (CPOF), increasingly utilizes non-linear interfaces. Non-linear interfaces use a customizable workspace that is based on the user's needs rather than a static data format, and interaction with the interface is not based on prescribed or hierarchical sequences of steps. These characteristics of CPOF as well as the type of training typically received on the system suggested that CPOF skills should be susceptible to retention loss. This paper describes the results of a CPOF-skill retention experiment. Thirty-six Soldiers from CPOF training at two battle command training centers completed a skills test immediately following training and again five weeks after training. Although retention of CPOF skills was fairly robust, differences among the patterns of individual-skill retention were found. In addition, differences were found in CPOF-skill retention across types of skills. The pattern of retention was then used to identify the specific skills and the progression of skills that are critical in developing CPOF expertise.

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RETENTION OF DIGITAL SKILLS: COMMAND POST OF THE FUTURE

EXECUTIVE SUMMARY

Research Requirement:

As the U.S. Army continues to provide Soldiers with the next generations of digital systems, the digital skills needed to employ these systems is evolving and may require the acquisition and retention of new skills. This is especially true for the digital systems used in tactical operations centers (TOC) and command posts. A Soldier's inability to utilize previously-learned digital skills while operating in a TOC degrades a unit's ability to effectively plan, execute, and respond to the battle. As a consequence, the ability to optimally train and sustain digital proficiency is needed to maintain battlefield readiness. Common wisdom is that digital skills are perishable yet little empirical evidence exists to document this assumption. Yet, it is not enough to simply know that digital skills are perishable. To plan effective training schedules, trainers and commanders must know which skills and knowledge are perishable and the types of training methods that most economically maintain skill retention.

Procedure:

Thirty-six Soldiers from CPOF training at two battle command training centers (BCTC) completed a skills test immediately following training and again five weeks after training. Skill retention on each of the 18 CPOF skills was individually analyzed for forgetting across the retention interval. Retention performance on each skill was also aggregated across CPOF-skill categories, i.e., Construct, Visualize, and Collaborate. Self-report questionnaires were used to determine Soldiers' levels of general computer experience, military experience, and experience with other Army digital systems that might influence CPOF-skill retention.

Findings:

Overall, Soldiers showed statistically significant forgetting of CPOF skills from the initial exercise to the retention exercise even though the retention was fairly high after a five-week retention period. The results further showed that retention loss was limited to 9 of the 18 CPOF skills analyzed. Likewise, there was less retention of Collaboration skills than the other skill categories.

Utilization and Dissemination of Findings:

While the skill-retention results did not specifically indicate a methodology for improving CPOF training, the pattern of retention was used to identify the specific skills and the progression of skills that are critical in developing CPOF expertise. The results further suggested that training techniques that leverage the execution of sub-goals and that illustrate overlapping CPOF procedures should most efficiently train CPOF skills. The results and the training implications for this research were briefed to BCTC leadership and CPOF trainers at three Army posts.

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Introduction

As the U.S. Army continues to provide Soldiers with the next generations of digital systems, the digital skills needed to employ these systems is evolving and may require the acquisition and retention of new skills. This is especially true for the digital systems used in tactical operations centers (TOC) and command posts. A Soldier's inability to utilize previously-learned digital skills while operating in a TOC degrades a unit's ability to effectively plan, execute, and respond to the battle. As new digital systems become more complex, there is a need for empirical evidence to identify critical digital skills and to determine an ideal training environment to enhance digital-skill retention. The present report provides data on the retention of digital skills for Command Post of the Future (CPOF), which can be considered the vanguard of the next generation of TOC digital systems.

CPOF is a dynamic visualization tool that supports decision making in a collaborative environment. CPOF can assist in planning tactical operations, in tracking battlefield operations, and in providing update briefings to leaders. To accomplish these functions, the CPOF interface uses a customizable workspace that is based on the user's needs rather than a static data format. An example of the CPOF workspace is given in Figure 1. Successful application of CPOF requires the user to decide which functions will best address a problem or need. While such an approach to digital-systems design offers more flexibility and generality of use, the flexibility of CPOF may also increase the complexity of learning the interface and thus present difficulty for digital-skill retention. Because the CPOF interface is mostly non-linear (i.e., interaction with the system is not based on prescribed or hierarchical sequences of steps and data), there is less internal cuing in the interface. Likewise, in non-linear interfaces, there are no indicators that a given task has been completed. As a consequence, proficiency with non-linear interfaces like CPOF requires a higher level of understanding of task goals and interface capabilities (Farrell & Moore, 2000).

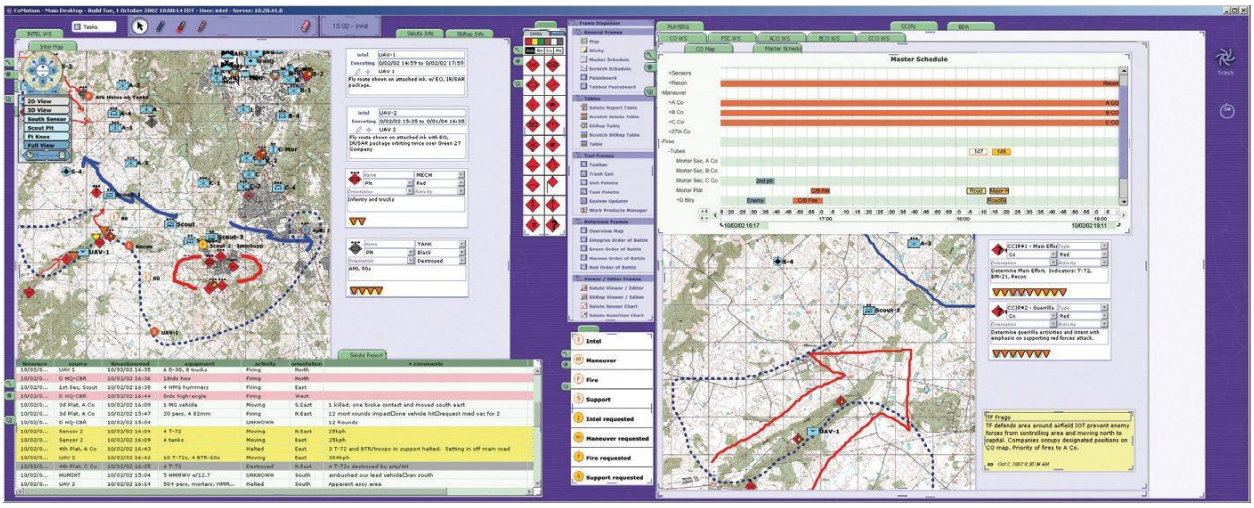

Figure 1. An example of CPOF workspace with various products displayed.

The complex and non-linear format of the CPOF interface makes the training and retention of CPOF skills particularly challenging (Catrambone, Wampler, & Bink, 2009). The difficulty in learning and retaining CPOF skills is likely based on the fact that the interface does not support and novices do not have the organization of knowledge necessary to intuitively interact with the system. What is more, there are few opportunities for individuals to practice CPOF skills because systems are generally only available in theater or in staff exercises. Thus, it was the goal of the present research to understand the pattern of CPOF digital skills retention in order to inform training.

By one view, the purpose of training is to execute skills in the appropriate context, and, oftentimes, the acquisition is separated from the execution context by an extended period of non-use (Arthur, Bennett, Stanush, & McNelly, 1998; Naylor & Briggs, 1961; Sauer, Hockey, & Wastell, 2000). As a result, the *sin qua non* of effective training is the ability to retain skills over a period of non-use (i.e., a retention interval). In general, digital skills are perishable, and as a consequence, digital-skills training methods should be sensitive to patterns of skill retention (Goodwin, 2006; Goodwin, Leibrecht, Wampler, Livingston, & Dyer, 2007). For example, it has been shown that a given training method may support short-term retention of a skill but not support long-term retention (Sauer et al.). Thus, identifying the more-perishable digital skills may help optimize digital-skill training methods.

While there appear to be a number of factors that influence skill retention, the interaction among skill characteristics (e.g., complex vs. simple skill), level of original learning (e.g., overlearning, method of training, etc.), and retention-interval characteristics (e.g., duration, access to practice, etc.) is most crucial for determining the level of skill retention (Arthur et al. 1998; Hagman & Rose, 1983; Lance et al., 1998; Naylor, Briggs & Reed, 1962). Obviously, if a skill is complex, was poorly learned, and has a long retention interval, the skill will not be well retained. Digital skills are generally considered complex cognitive skills because the purpose of these skills is the application of the digital system to solve a problem in a given context. Even though the interactions with digital-system interfaces are largely procedural, hierarchical knowledge of the system is required to effectively navigate digital interfaces and to optimize problem solving (Catrambone et al., 2009; Davis & Yi, 2004). Because digital skills require complex knowledge, digital skills should be susceptible to skill-retention loss.

Training battle staff on TOC digital systems, including CPOF, generally occurs in some combination of an 8 – 24-hour familiarization course, a 15 – 40-hour operators course, and on the job training (cf. Catrambone et al., 2009; Goodwin, 2006; Sanders, 1999; Schaab & Moses, 2001). Classroom training methods may vary across digital systems but mostly include a combination of instruction, procedural modeling, and practical exercises (see Goodwin et al., 2007; Schaab & Moses). Procedural modeling (i.e., trainees watch an expert perform a function or routine and then perform the function themselves) has been shown to be effective in training digital skills (see Davis & Yi, 2004), but the efficacy of this method for training Army digital systems (within the context of classroom training) is in question. For example, training Force XXI Battle Command Brigade and Below (FBCB2) and its predecessor inter-vehicular information system were based on the procedural modeling method, but the skills on these digital platforms have been shown to be quite perishable (Goodwin et al. 2007; Goodwin, Tucker, Wampler, Gesselman, & Johnson, under review; Sanders). So, again, it may be that even with effective training methods, skill retention for CPOF may be problematic.

Another common characteristic of TOC digital-systems training is that there is a significant gap in time between skills training and skills use in an active battle staff assignment. In that retention interval, Soldiers do not have access to systems on which to practice (Goodwin et al., 2007; Schaab & Moses, 2001). Although there are no empirical estimates of the formal retention interval for digital-skills training, the research evidence suggests that there is significant skill-retention loss after as little as four weeks (Goodwin et al.; cf. Schaab & Moses). In the case of CPOF, Soldiers who complete familiarization training or operator training typically do not have the opportunity to use the system until a staff exercise or deployment, which can be several months after training. As a consequence, the retention interval for CPOF skills will likely lead to significant skill loss.

In order to better understand the retention properties of CPOF skills, it is necessary to define CPOF digital skills. Even though digital skills are generally thought to be complex cognitive skills, a "skill" can vary from being able to power-up the system to being able to communicate orders in a combat mission (see Bink, Wampler, Goodwin, & Dyer, 2009). One recent attempt to define the nature of CPOF skills utilized an execution–based knowledge elicitation process to identify "critical" CPOF skills and the interdependencies of the skills (Catrambone et al., 2009). Catrambone et al. identified approximately 50 unique CPOF skills and defined the sub-goals associated with the execution of each of those skills. What is more, Catrambone et al. organized the CPOF skills into four hierarchical categories based on both relations of the individual skills and the functional characteristics of the CPOF system (i.e., the construction, display, and sharing of tactical "products" within CPOF). The organization of the hierarchy emphasized the main functional components of CPOF with its military application implicit within the categories. Accordingly, the CPOF system is characterized by four main functional groupings of skills: Construct, Visualize, and Collaborate, and System Basics.

"System Basics" are the most basic-level skills and refer to the tools and processes needed for system operation and the system interface (e.g., how to properly apply mouse clicks). "Construct" skills are also basic-level skills and are used to construct simple products by applying the basic system tools (e.g., creating a map from the Frame Dispenser). "Visualize" and "Collaborate" skills are the highest-level skills, are interdependent, and allow for the application of CPOF in a tactically-relevant manner. These higher-level CPOF skills allow the user to visualize current and past battlespace information (e.g., creating a Pasteboard) and to interactively share that information with other decision makers (e.g., importing a product to the PASS Tree).

The present research tracked the retention of certain CPOF skills identified by Catrambone et al. (2009). The curious reader is invited to review the Critical Skills Document contained in Catrambone et al. for a more thorough description of each skill. It is important to note that in both Catrambone et al. and the present report, the consideration of CPOF skills did not focus on the skills used for the "3-dimensional" display. The CPOF 3-dimensional display includes skills specific to that display, and because of bandwidth issues, the 3-dimensional display is sparingly used in most TOC applications. Thus, the focus of skill retention reported here only addresses skills used for the "main" (i.e., 2-dimensional) CPOF display.

Given the complex nature of digital skills in general, the type of typical CPOF training, and the CPOF skill-retention intervals, CPOF skills should show significant loss of retention. However, it is not clear if all CPOF skills will have the same rates of retention loss. Because of the hierarchy of CPOF skills, it may be the case that certain types of CPOF skills are more susceptible to forgetting than others. For example, the Construct skills contain a common set of sub-goals that are reinforced in training. The procedural nature of the Construct skills and the common sub-goals across these skills suggest that retention should be robust (ref. Catrambone et al., 2009; Lance et al., 1998). By contrast, the higher-level skill types, i.e., Visualize and Collaborate, require more system knowledge as well as a certain degree of military-operations knowledge. The requisite system knowledge for higher-level skills is not easily acquired (Davis & Yi, 2004; Dorsey, Campbell, Foster, & Miles, 1999) and may require different training methods than procedural skills (Catrambone, 1998; Ericsson, Krampe, & Tesch-Romer, 1993). As a result, there will likely be more forgetting for the higher-level CPOF skills than for the lower-level skills. As will be seen, the results reported here will provide evidence to test this prediction.

The research reported here was designed to answer three basic questions: to what degree are CPOF skills susceptible to retention loss; if there is significant loss of retention, which CPOF skills show greater retention loss; and what does the pattern of skill retention loss, if any, indicate about potential training approaches for CPOF. To address these questions, skill-performance data was collected from Soldiers completing 24 hours of CPOF training. The Soldiers had little prior experience with CPOF and varied in both digital-system experience and military experience. The present research effort compliments recent FBCB2-skill retention research efforts as a means to optimize training of digital skills (see Goodwin, et al., 2007; Goodwin, et al., under review). For example, in a comparison of FBCB2-skill retention (Goodwin, et al., under review), it was shown that there are some key steps on some procedures that should be emphasized during training. In addition, the patterns of skill retention differed between Soldiers in distance learning classes and Soldiers in traditional classes, which suggested that some characteristics of the distance-learning environment may be effective for training digital skills. While it was not the intent of the current research to compare retention rates across different training environments, it is not unreasonable to expect that any difference in the patterns of CPOF-skill retention could indicate what types of training might enhance retention.

Method

Participants

Thirty-six Soldiers from CPOF training at two Battle Command Training Centers (BCTC) completed a skills test immediately following training and again about five weeks after training. The Soldiers ranged in rank from Private First-Class to Command Sergeant Major and Captain and ranged in time-in-service from 15 months to 324 months (i.e., 27 years). In general, the Soldiers were Specialists or junior non-commissioned officers with less than 60 months time-in-service. Most Soldiers had some TOC experience. Six Soldiers were unable to successfully complete the retention test because of duty requirements. As a consequence, the reported analyses were based on a total sample of 30 Soldiers.

Materials and Procedure

All Soldiers completed 24-hour CPOF training at a BCTC. As part of the training course, Soldiers completed an end-of-course practical exercise (i.e., initial practical exercise). The initial practical exercise took over three hours for Soldiers to complete (M = 3.34hr., SEM = .24). Soldiers then returned to the BCTC four to six weeks later depending on duty schedule. The mean retention interval was 37 days (SEM = 1.16). Upon return to the BCTC, each Soldier completed a second practical exercise to assess the retention of CPOF skills (i.e., retention practical exercise). Soldiers also required over three hours to complete the retention exercise (M = 3.68hr., SEM = .28) and were debriefed at the conclusion of the exercise.

The initial practical exercise required each Soldier to apply skills learned in training by preparing CPOF overlays and products that might be used for a battle-update brief. The retention practical exercise was similar, though not identical, in format and in content as the initial classroom practical exercise. That is, the same skills were utilized in each practical exercise although the specific information used to complete the two practical exercises differed. For example, the initial exercise required Soldiers to create a product for a forward operating base near Samarra and name the product "FOB Danbury" while the retention practical exercise required Soldiers to make a product for a forward operating base near Baghdad and name the product "FOB Apache." Appendix A provides the items from the retention practical exercise as an example of the types of items that were used on *both* practical exercises.[1] As can be seen in Appendix A, successfully accomplishing a given practical-exercise item may have required the Soldier to correctly apply different and multiple CPOF skills. It is important to note that there were multiple instances of a given skill (e.g., "Create a Unit") on the practical exercises.

At the completion of each practical exercise, a course instructor reviewed each Soldier's practical exercise on the CPOF system and noted on a checksheet whether each item was successfully completed. The checksheet listed each specific CPOF task component required to complete the practical-exercise items, and the Soldier was given a "Go" for successful completion of the task component or a "NoGo" if the task component was not successfully completed. It is important to note that the task components were associated with specific CPOF skills identified by Catrambone et al. (2009). Thus, it was possible to quantify each Soldier's skill proficiency on 18 specific CPOF skills. Appendix B provides a copy of the retention practical exercise checksheet. The copy of the checksheet indicates which CPOF skill was associated with each practical-exercise task component. It is important to note that the same instructor at both BCTCs reviewed both practical exercises (i.e., initial and retention). As a result, there were no issues with inter-rater reliabilities.

Soldiers also completed a brief demographic questionnaire at the conclusion of the initial practical exercise. The questionnaire contained items about the Soldier's general military experience (e.g., time in grade) and experience with relevant digital systems (e.g., FBCB2). A copy of the demographic questionnaire is provided in Appendix C. At the completion of the retention practical exercise, Soldiers completed a second questionnaire. This questionnaire was designed to assess the degree to which the Soldiers had any digital-system experience or training

[1] Because the initial (i.e., end-of-course) practical exercise is current training material, a copy of that practical exercise was not included in this report in order to maintain the proprietary nature of the material.

in the retention interval that could affect CPOF skill retention. Most importantly, the retention questionnaire was used to determine if Soldiers had access to CPOF during the retention interval. Appendix D provides a copy of the retention questionnaire.

Results

Throughout this paper, statistical significance was based on the five-percent level of alpha error. The pair-wise comparisons of means were analyzed with one-tail tests because only decreases in performance values were of interest. That is, the main purpose for the analyses was to identify CPOF skills that were not retained (i.e., statistically significant lower performance on the retention exercise than the initial exercise). If a skill was retained, it was of no of consequence to these analyses if the skill increased or stayed the same across the retention interval. Post-hoc differences in means were determined by pair-wise comparisons of 95% confidence intervals. Where appropriate, group means and standard errors of the mean are given in the text.

Individual CPOF Skills

Individual items from each practical exercise were aggregated according to the individual CPOF skills represented in order to allow comparisons across exercises (refer to Appendix B). The proportion correct (i.e., rated a "Go") of all items within each skill was calculated for both the initial practical exercise and the retention practical exercise. Comparisons (i.e., paired *t*-tests) were performed on the proportions from each exercise for each skill.

In general, retention of CPOF skills was fairly good over the retention interval. When aggregated across all CPOF skills assessed, Soldiers showed statistically significant forgetting of CPOF skills from the initial exercise to the retention exercise ($t(29) = 2.81$, $MSE = .037$). However, the proportion of correctly executed CPOF skills only decreased by about 11% from the initial exercise ($M = .94$, $SEM = .02$) to the retention exercise ($M = .83$, $SEM = .04$), and the proportions were fairly high even after a five-week retention period.

Each of the 18 CPOF skills assessed in the practical exercises was individually analyzed for forgetting across the retention interval. As shown in Table 1, nine of the CPOF skills showed no statistically significant forgetting (i.e., the skills were "retained"). Likewise, nine of the CPOF skills showed a statistically significant decrease in proportion correct across the initial exercise and the retention exercise (i.e., the skills were "not retained"). The largest difference between proportion correct across initial and retention exercises was for "PASS: import & display product," ($t(29) = 3.03$, $MSE = .068$) which showed about a 20% decrease in performance (initial mean = .94, $SEM = .03$; retention mean = .74, $SEM = .07$).

Table 1.
Mean Proportions of Correct Responses for CPOF Skills Retained and Not Retained.

	CPOF Skills	Initial Exercise	Retention Exercise	CPOF Skill Category
Retained	Set Automatic Layout	.96 (.03)	.88 (.05)	Construct
	Create Graphic	.97 (.01)	.94 (.03)	Construct
	Name/Label Graphic	.99 (.01)	.95 (.03)	Construct
	Set Event Table Properties	.90 (.06)	.82 (.07)	Construct
	Create and Name Pasteboard	.96 (.02)	.93 (.03)	Visualize
	Create Master Schedule	.93 (.05)	.97 (.03)	Visualize
	Create, Name, & Nest Map	.97 (.02)	.90 (.04)	Visualize
	Create, Name, & Place Effort	.99 (.01)	.92 (.04)	Visualize
	Set Privileges	.85 (.06)	.73 (.08)	Collaborate
Not Retained	Locate Product	.99 (.01)	.90 (.03)	Construct
	Populate Effort (Clone product)	.98 (.01)	.92 (.04)	Construct
	Create Unit	.99 (.01)	.95 (.03)	Construct
	Create Event	.95 (.04)	.80 (.07)	Construct
	Set Event Properties	.97 (.03)	.83 (.07)	Construct
	Create Stickie	.90 (.05)	.72 (.08)	Construct
	Create & Name Map Preset	.99 (.01)	.88 (.05)	Visualize
	Set Preset View	.91 (.03)	.81 (.06)	Visualize
	PASS: import & display product	.94 (.03)	.74 (.07)	Collaborate

Notes. Standard errors of the mean are given in parentheses. "Not Retained" was defined as *no* statistical difference between means.

CPOF Skill Categories

Retention performance on each skill was also aggregated across skill categories identified by Catrambone, et al. (2009), i.e., Construct, Visualize, and Collaborate. In order to specifically understand how CPOF-skill retention varied as a function of the types of skills, proportions of correct responses for the practical exercises were compared across CPOF skill categories. The resulting analysis yielded a statistically significant interaction between skill retention and skill category ($F(2, 58) = 3.22$, $MSE = .019$). Figure 2 displays the nature of the interaction. Accordingly, there was a statistically-significant lower proportion correct for the retention exercise ($M = .83$, $SEM = .04$) than for the initial exercise ($M = .93$, $SEM = .04$) regardless of skill category ($F(1, 29) = 7.11$, $MSE = .068$). However, there was a larger difference between proportions correct for Collaborate than either Construct or Visualize. Thus, there was less retention of Collaboration skills than the other skill categories.

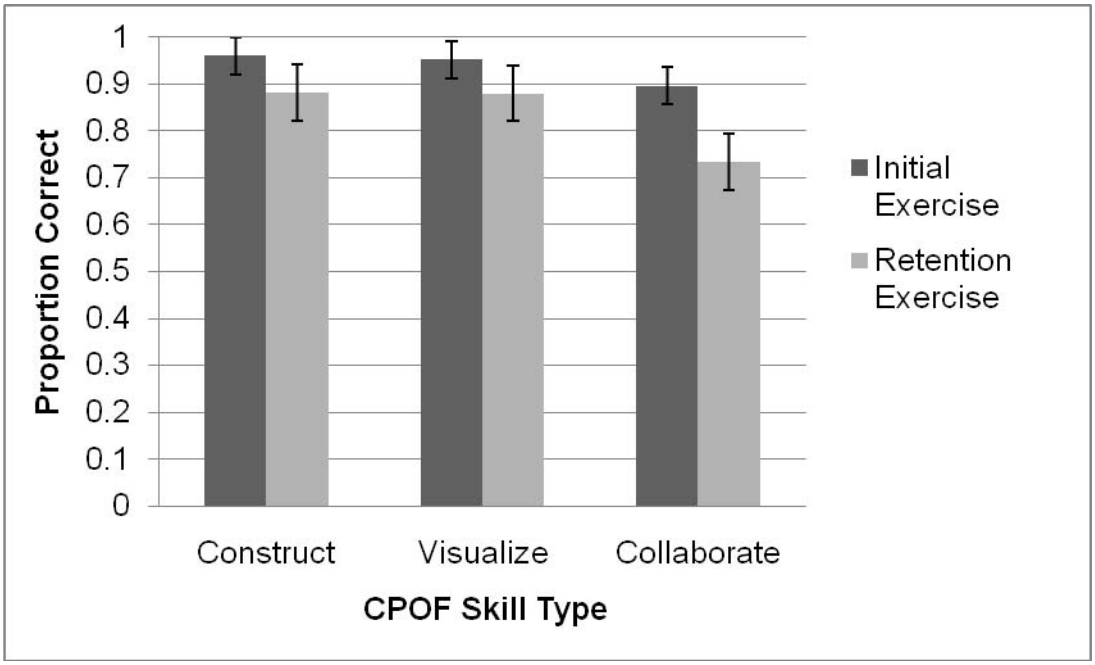

Figure 2. CPOF skill retention as a function of skill categories. Error bars represent 95% confidence intervals.

In addition to the patterns of retention, the correlations of difference scores among the CPOF-skill categories indicated that Collaborate skills did not share the retention properties of the other skills. Difference scores for the CPOF-skill categories were derived by subtracting the proportion of correct responses on the initial practical exercise from the proportion correct responses on the retention exercise for each skill and then aggregating the difference scores across skill categories. While difference scores of Construct skills and Visualize skills were highly correlated (r = .84), Difference scores for Collaborate skills were only moderately correlated with both Construct (r = .55) and Visualize (r = .56). Thus, it appeared that Visualize and Construct skills shared characteristics that likely contributed to the retention of the skills. Those shared characteristics are most likely the sub-goals of the skills, but Visualize and Construct skills may also have shared training overlap. That is, the training program of instruction for the CPOF courses focused heavily on Visualize skills, and as a consequence, the Construct skills were introduced in training as a means to develop Visualize products.

It was predicted that Construct skills should be better retained than either Visualize skills or Collaborate skills because Construct skills have more common sub-goals and are precursors for the higher-level skills. The data did not support this prediction because the retention of Construct skills and Visualize skills shared retention properties (i.e., levels of retention and correlations between retention performances) and both differed from Collaborate skills. In addition, in reconsidering the pattern of skill retention for the individual CPOF skills listed in Table 1, it is important to note that skills from each CPOF-skill category were both retained and not retained but that Visualize skills had the greater proportion of retained skills. That is, two-thirds of the Visualize skills were retained while only about half of both Construct skills and Collaborate skills were retained. It is also important to note that the retention of individual CPOF skills varied more as a function of skill sub-goals than of the type of skills. That is,

creating a map was a skill that was retained, but creating an event was not retained. The main difference between these skills is that creating an event involves the additional sub-goals of providing specific information in specific fields of the product in addition to creating the product form the frame dispenser and locating the product on a map. The sub-goals of providing specific information in the product are shared by most of the other "not retained" skills but are not required by the "retained" skills. This difference between the retained skills and not-retained skills is important because training should take advantage of sub-goal overlap to develop skills (Catrambone, 1998; Catrambone, et al. 2009).

Additional Factors Influencing Skill Retention

On the demographic questionnaire that each Soldier completed, there were a number of items that assessed the amount of training and experience the Soldier had with general computer skills (e.g., Microsoft applications) as well as with specific Army digital systems (e.g., FBCB2 and All Source Analysis System). In addition, the demographic questionnaire assessed the level of military experience each Soldier had, such as time in service, the number of professional military courses, and time deployed. The individual questionnaire items were aggregated into composite indicators of general computer experience, military experience, and experience with two individual Army digital systems (i.e., FBCB2 and CPOF). For example, military experience indicator was created by aggregating responses from time-in-service, amount of staff experience, and number of professional military courses. Likewise, experience with Army digital systems, including CPOF, was a composite of responses from items of individual and unit training, deployment usage, and self-rated proficiency with each system.

Each of these dimensions (i.e., general computer experience, military experience, and individual Army digital systems experience) was correlated with retention performance for the three CPOF-skill categories (i.e., Construct, Visualize, and Collaborate) as well as with overall retention performance. None of the correlations between the CPOF-skill categories and military experience were statistically significant (highest $r = .18$). Likewise, there were no statistically significant correlations between CPOF-skill categories and either FBCB2 experience (highest $r = .29$) or prior CPOF experience (highest $r = .28$). By contrast, the level of general computer experience statistically correlated with overall retention ($r = .42$), retention of Construct skills ($r = .36$), and Visualize skills ($r = .47$), but there was no statistically significant correlation between general computer experience and Collaborate skills ($r = .30$). As a result, it appeared that neither military experience nor experience with specific Army digital systems contributed as much to CPOF-skill retention as did general computer experience.

One of the design principles for CPOF was to base the interface on common personal-computer procedures such as drag-and-drop and copy-and-paste. The fact that general computer experience correlated with CPOF-skill retention seemed to indicate this design principle was met. That is, the results suggested that there was a positive transfer from general computer experience to CPOF skills. However, these results should be interpreted with caution because the questionnaire was a simple experimental tool and not a validated instrument. A more systematic investigation of the transfer of general computer skills to CPOF skill may, nonetheless, be warranted.

Eight Soldiers reported having used CPOF during the retention interval, but seven of the eight reported using CPOF only once. Even though this level of retention-interval use was so slight, a comparison of CPOF-skill retention (i.e., proportion correct across all skills) was conducted between those who used CPOF during the retention interval and those who did not use CPOF during the retention interval. Statistically, there was no difference between the retention of CPOF skills for those who used the system in the retention interval and those who did not ($F < 1$). As a consequence, the limited exposure to CPOF during the retention interval did not aid the retention of skills.

Discussion and Recommendations

In summary, even though overall retention of CPOF skills was high, there were differences in retention across skills. In particular, Collaborate skills had the largest decline in retention, but skills in each CPOF-skill category demonstrated forgetting. These results carry implications not only for the general understanding of digital-skill retention but also for the understanding of CPOF-skill training.

Digital-skill Retention

The present results add to the empirical evidence for the loss of retention of digital skills for Army digital systems. More specifically, the results showed that retention loss occurred for the complex and non-linear interface over a relatively short interval and with high initial performance. The fact that retention loss occurred for a non-linear interface, such as CPOF, was not surprising. Non-linear interfaces do not provide the same degree of internal cuing as do menu-driven linear interfaces (e.g., FBCB2) and may require discrete representations of procedural execution even for related skills. Such was the case for the present results. For example, creating an effort was a retained skill while creating an event was not retained. Both of these skills have a common set of procedures (e.g., both are pulled from the frame dispenser, both require text-field input, and both are located on maps in the same way), but the commonality of procedures clearly did not lead to performance transfer across skills.

The fact that the present research had both a relatively short five-week retention interval and very high initial skill performance (i.e., $M = .94$) further suggested that digital skills are particularly susceptible to retention loss. Loss of digital-skill retention has been shown with as little as a 30-day interval (Sanders, 1999) while performance on other complex skills showed no retention loss after as long as eight months (see Sauer, et al., 2000). The present results clearly demonstrated that digital skills can be quickly impaired if not practiced. Interestingly, the loss of retention for CPOF skills occurred even though performance was quite good immediately after training. However, none of the Soldiers in the present research had the level of training previously shown to reduce skill loss. That is, the CPOF training used by the BCTCs did not include *overlearning*, which is additional training beyond skill proficiency (Farr, 1987; Schendel, Shields, & Katz, 1978). In addition, there was no relation between initial level of performance on CPOF skills and performance after the retention interval ($r = .22$). Thus, it was difficult to determine if the loss of retention of CPOF skills was due to or in spite of the level of initial performance.

Another implication for the relatively high rates of initial performance was that perhaps the CPOF interface is not as overly complex as previously suggested (Catrambone, et al., 2009; Middlebrooks, 2008). Even though CPOF was designed to fulfill a complex operational role, the CPOF interface was designed to resemble current personal-computer interfaces. In fact, the present results showed that, overall, the more general computer experience Soldiers had, the more CPOF skills were retained. Perhaps, the perception of complexity for CPOF is based more on the operational application of the system rather than on the skills used to interface with the system.

Even though the current results support the position that digital skills are perishable (i.e., Goodwin, 2006), general statements about the susceptibility of digital skills to retention loss should be avoided. Currently, there is no consensus in the research literature about the perishability of digital skills. For example, no statistically significant loss of retention was found for All Source Analysis System/Remote Workstation skills in military analysts after a three-to-four month retention interval (Schaab & Moses, 2001). Likewise, both the present results and the results of Goodwin et al. (under review) indicated that, even though there was overall loss of retention, not all individual digital skills were susceptible to retention loss. In the case of Goodwin et al., overall performance on multi-step procedures showed retention loss whereas critical portions of the multi-step procedures showed no loss of retention. As for the present results, the overall loss of retention was driven by half of the individual skills tested. That is, there was statistically significant retention loss for nine of the individual CPOF skills and no loss of retention for the other nine CPOF skills tested. What is more, skill retention varied as a function of CPOF-skill categories in the present results, and there was no consistent pattern of retention across skills that shared sub-goals. The lack of a cohesive pattern of results across the digital-skill retention literature suggested that a more systematic investigation of digital skills is needed before general statements about the retention properties can be made.

Because skill retention depends on the interaction of skill characteristics, level of original learning, and retention-interval characteristics (Arthur, et al., 1998; Naylor & Briggs, 1961), future research designed to simply document the presence of or lack of digital skill retention will have limited applicability. Merely demonstrating loss of digital-skill retention cannot help guide training unless other factors are appropriately considered. However, patterns of skill retention observed in a given training environment can be used to determine a sequence of training. For example, as will be described, the results from the present research can be used to suggest that training CPOF skills that were better retained should precede the training of skills that were not retained. What is more, training the better-retained skills should be reinforced as more focus is given to training the skills that were not retained. Likewise, the types of training modalities used to train CPOF skills can be chosen to leverage the pattern of skill retention.

Training CPOF Skills

In general, sequencing training for complex skills, like digital systems, should begin with skills that provide effective strategies (Clawson, Healy, Ericsson, & Bourne, 2001) or with skills that leverage common sub-goals (Catrambone, 1998). In the case of CPOF skills, applying these two general guidelines was a matter of determining which skill sub-goals were common across both retained skills and skills not retained. The set of common sub-goals is listed in Table 2. These skill sub-goals represent the general procedural steps for producing many of the CPOF

products and can be generalized as new skills are introduced in training. Training these specific sub-goals up front and continually reinforcing them as new skills are trained should be a way to provide an effective learning strategy.

Table 2.
Order of Execution of Common Sub-goals for CPOF Skills.

CPOF Skills Sub-Goals
Retrieve item from Frame Dispenser
Input product information and Name
Drag product to desktop
Use drop down boxes to select features
Drag to desired location on Pasteboard
Click "Nesting Icon" while available

Training the common sub-goals is just the first step in defining the sequence of CPOF-skills training. Based on the retention properties of CPOF skills and the general guidance on sequencing the progression of skills (i.e., Catrambone, 1998; Clawson, et al., 2001), a sequence of skills training can be defined. A set of basic CPOF skills should be first introduced because general system knowledge supports the execution of specific CPOF skills (Catrambone et al., 2009). These basic skills represent the general functionality of CPOF and are common across the CPOF-skill categories. The three most basic CPOF skills are using the Frame Dispenser (i.e., the source for creating most other products), creating a Pasteboard (i.e., the highest level product and most operationally relevant), and creating a Map (i.e., the most basic visualization tool).

After these basic skills are introduced, a set of skills that are better retained and that have the sub-goals listed in Table 2 should be trained. Doing so will reinforce the basic sub-goal procedures and will introduce relatively easy skills. Likewise, this set of skills should be Construct skills because Construct skills support the higher-level skills. The next steps in the progression are to introduce more difficult (i.e., skills not retained) Construct skills, introduce Visualize skills that were retained, and continue to train retained and not-retained skills as higher-level skills are introduced. Table 3 displays a suggested progression of skills training and provides examples of specific CPOF skills taken from the current research that apply to each level of the progression.

By following this progression, increasingly complex skills or skills that are more susceptible to forgetting can be trained in the context of "easier" skills. The specific skills introduced at each step of the sequence can be determined not only by the procedural commonality with already-learned skills but also by the operational relevance of the skill (e.g., creating a unit in the context of battle tracking). With these two factors in mind (i.e., the progression of skills and operational relevance), specific training problems can be constructed to form the basis of the training approach. The problems should be developed across the different CPOF purposes (i.e., battle tracking, battle planning, and update briefing) and should require decision making and collaboration at every level.

Table 3.
Suggested Progression of CPOF Skills Training.

	Progression of Skills	Example Skills to be Trained
1	Train some basic system skills.	Starting and Stopping the System
2	Introduce basic CPOF products.	Create Pasteboard; Create Map
3	Introduce Retained Construct skills, and have students apply that knowledge in an operationally-relevant problem-solving task.	Create Graphic
4	Introduce Not-Retained Construct skills and Retained Visualize skills that incorporate common sub-goals, and have students apply that knowledge.	Create Unit; Create Effort
5	Introduce Not-Retained Visualize skills and Retained Collaborate skills that incorporate common sub-goals, and have students apply that knowledge.	Set Preset View; Set Privileges
6	Continue to introduce and incorporate more complex skills while reinforcing the training with application.	PASS: Import & Share product

Even though the proposed training progression is a logical extension of the available data, several issues remain unresolved. These issues may impact the actual efficiency of the proposed progression and the way in which the proposed progression can be implemented. First, not all important CPOF skills were tested for retention (e.g., Workspace Management). Including these untested skills would be necessary for any new CPOF-training approach, but not enough information is available at this time to determine where these important and untested skills would be introduced in the training sequence. Second, the retention properties of CPOF skills would likely change as a result of the type of training used (Arthur et al., 1998). Thus, in order to properly sequence skills training, the retention of CPOF skills would need to be assessed after the proposed training approach is implemented, and the sequence of training should be modified according to those results.

The current results do not prescribe a specific training modality for CPOF skills. However, research on training other digital systems suggests that problem-based training was effective for complex systems like CPOF. For example, in the comparison of constructivist training techniques (e.g., problem-based training) to lecture-based training for the All Source Analysis System and the Advanced Field Artillery Tactical Data System, results showed that problem-based training produced higher scores than lecture-based training on the performance-based practical exercises at the end of digital-skills courses (Childs, Blankenbeckler, & Dudley, 2001; Childs, Schaab, & Blankenbeckler, 2002). In addition, Childs et al. (2002) reported that

problem-based training allowed for more material to be trained in less time without the perception of additional workload.

Of course, problem-based techniques might be only one tool for training CPOF skills based on the results presented in this paper. The structure of the proposed training progression suggested that a mix of training techniques may be appropriate. For example, providing direct instruction on the System Basics should precede problem-based exercises in order to provide requisite system knowledge. From that point, a series of problems that focus on simple sub-goals and a progression of skills could be executed. It may also be the case that the progression of skills training could be accomplished with an effective technique such as deliberate practice (e.g., Ericsson et al., 1993). However, the main advantage of a problem-solving approach is that the relations among skills can be implicitly trained without additional explicit training on the structure among skills.

Conclusion

Given the increasing complexity and non-linearity of Army digital-systems interfaces, traditional digital-system training approaches (i.e., memorization of key strokes and menus) will limit the degree of training efficiency. In order to avail oneself of the capabilities of complex non-linear systems, the user must know the system capability and understand how the system can be applied to meet operational needs. That is, the user must not only know how to do things, but also know when to do them (i.e., decision rules). The approach to training development offered in this paper specifically allows hierarchical knowledge of complex non-linear digital systems to be trained.

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Acronyms

BCTC	Battle Command Training Center
CPOF	Command Post of the Future
FBCB2	Force XXI Battle Command Brigade and Below
TOC	Tactical Operations Centers

APPENDIX A

RETENTION CPOF PRACTICAL EXERCISE

Create a Pasteboard:

Pasteboard Name: ROLE NAME Overlay PE

Create and Nest Map.

A. Create the following map Presets

1. Go to this grid, 38 SLF 31897 23368, to create a GeoStickie on the 2D map in Mosul. Zoom in on the GeoStickie to Imagery View. Make a Preset, Name it Mosul.
2. Go to this grid, 38 SMB 07669 07879, to create a GeoStickie on the 2D map in Karbala. Zoom in on the GeoStickie to Imagery View. Make a Preset, name it Karbala.
3. Go to this Grid, 38 SLB 86788 91606. Make a Preset, name it Fallujah.

B. Create DIV/BDE/BN Boundaries

1. ***Division Boundary*:** Draw a Boundary from 38SMC 17756 03889 to 38SMC 63530 06307 and a separate Boundary from 38SMB 18407 72092 to 38 SMB 64239 71375.
2. Change Echelon to Division.
3. Label both sides of the Division Boundary in the Unique Designation block or 26 Font Text:
   Northern Boundary – **MND-C** on North side & **MND-B** on the Baghdad side.
   Southern Boundary – **MND-B** on the Baghdad side and **MND-S** on the South side.
4. ***Brigade Boundary*** – From North to South Division Boundaries, follow the River in the center of Baghdad with a Brigade Boundary; Label the brigade boundary on the west side **1BCT** in 20 font. Label the brigade boundary on the east side **2BCT** in 20 font. Be careful when labeling the boundaries with the Unique Designation.
5. ***Battalion Boundary*:** Draw Battalion Boundaries within the 1BCT area for 1-5 (west) and 1-8 (east): 38SMB 18902 72555 to 38SMB 41510 89501. Draw Battalion Boundaries within the 2BCT area for 2-5 (west) and 2-8 (east): 38SMB 44732 87664 to 38SMC 62864 02618.
6. ***Phase Lines*:** Draw a phase line from 38SMB 15467 88205 to 38SMB 65462 88311. Color the phase line red and label it **PL RED**.
7. Drag an Effort, name it **BOUNDARIES AND PHASE LINES.**
8. Drag all graphics to the Effort and drag-drop the Effort to the Effort List.

C. Create Units

1. Create the following units and put them on the grid listed:
   - **1BCT** – 38SMB 29362 94788 Infantry Mech
   - **1-5BN** – 38SMB 23144 83844 Infantry Mech
   - **1-8BN** – 38SMB 37291 78122 Armor
   - **2BCT** – 38SMC 42900 00402 Armor
   - **2-5BN** – 38SMB 51253 98290 Armor
   - **2-8BN** – 38SMB 54339 85382 Infantry Mech
2. Drag an Effort, name it **BDE/BN** Units and drag effort to the effort list.

D. Manage the 3D Map

1. Go to the Fallujah preset, build an Air Path *along the road* starting at: 38SLC 59149 26437 and ending at: 38SMB 08845 84614; what is the distance of the Air Path? Add a Stickie to the map at either end of the Air Path with the distance.
2. Still on the Fallujah preset, create a Blue Assertion/Field Artillery Battalion. **Name it 2-82**, and drop on map.
3. Create a Red/Hostile/Kidnapping event, name it **CNN Reporters**, drop on map.
4. Create a Distance Tool.
5. Save all your Graphics and Events in an Effort and name it **3D Map PE**, drag to the map.

E. Create Events and Edit Graphics

1. Go to the Mosul Preset, add the following events with the attached event description:
   - **SAF** – A 1-5CAV patrol was attached with SAF in Baghdad ivo 38SMB 3410 8770. While investigating suspicious activity, the patrol was attacked with 4 x rounds of SAF. There were no injuries or damages reported.
   - **IED** – A D/1-9 CAV patrol was attached with an IED ivo of Baghdad at 38SMB 3830 6040. There was 1 x WIA (shrapnel to left leg and left shoulder), and 1 x disabled M1025.
2. In Mosul, add a Division Boundary; pick any road on this preset and make it an MSR.
3. Still in Mosul, edit the MSR and make it an ASR.
4. Save all the graphics and Events in an effort, name it **Mosul Graphics**, drag to the map.

F. Pasteboards, Nesting and Layouts

1. Rename the current map your **[ROLENAME]**.
2. Drag two separate Pasteboards with Maps nested. Name one pasteboard **[ROLENAME] BTL CPT WS**, and the other **[ROLENAME] BTL CPT COP**.
3. Nest these two pasteboards on your Overlay PE Pasteboard, drag a Master Schedule, Events Table and a Table, and nest to the Overlay PE Pasteboard. Organize your pasteboards in Automatic Layout.

G. Privileges

1. Give Privileges to your BTL CPT WS Map to any User Role.
2. Give Privileges to the BTL CPT COP Pasteboard to any User Role.

H. Shared Products

1. Drag out a Shared Products from the Frame Dispenser, drag-drop the Blue SA Effort from the Shared Products to your map; activate the Current PLI.
2. Subscribe to the PASS, drag-drop an MCS Overlay called Annex_C_BDE_FRAGO_01-07 and MND_I_ANNEXC to the BTL CPT WS map, show on the map.
3. Subscribe to the PASS, drag-drop an ASAS overlay called 2BCT_Ethnicity on the BTL CPT COP Map and show.
4. Subscribe to the PASS, drag-drop a BCS3 overlay called CORPxANNEXIxMSR on the BTL CPT COP map and show.

THIS ENDS THE PRACTICAL EXERCISE

APPENDIX B

RETENTION CPOF PRACTICAL EXERCISE CHECKSHEET*

*The specific CPOF skill associated with each checksheet item is given in the "Comments" column. On the actual checksheets, the Comments column was used to describe why an item was a "NoGo."

CPOF Skill Retention Scoring Checklist

Retention Practical Exercise

GOAL

The goal of the observation is to document the student's results from the CPOF practical exercises.

SCORER'S DUTIES

- Use the sign-in roster to determine the amount of students available
- Provide 1 Demographic questionnaire, 1 Scoring Checklist, and 2 Take Home Sheets per Student
- Upon completion of the Practical Exercise:
    - verify Student's information
    - verify the Student has 2 copies of the take home document
    - begin the scoring procedure.
- On the checklist, **provide a comment for each "no" rating** to indicate what mistake was made.
- After the event, organize all notes and protocols, then deliver them to the Data Compiler.

ADMINISTRATIVE DATA

1. ID Number _____
2. Computer Role Name _____
3. Date of Observation _____
4. Practical Exercise Start Time (24 hr clock)_____
5. Practical Exercise Stop Time (24 hr clock)_____

Task 1 *Create Pasteboard*				Comments
a	**Pasteboard Name: ROLE NAME Overlay PE**	**Go**	**No Go**	*Create and Name Pasteboard*
b	**Nested Map Name: ROLE NAME**	**Go**	**No Go**	*Create, Name, & Nest Map*

Role Name Map –Mosul Preset

Task 2 *Create Presets*				Comments
a	**Label: Mosul**	**Go**	**No Go**	*Create & Name Map Preset*
b	**Loc: 38SLF 31897 23368**	**Go**	**No Go**	*Create & Name Map Preset*
c	**Zoom Level: Imagery**	**Go**	**No Go**	*Set Preset View*

Role Name Map – Karbala Preset

Task 3 *Create Presets*				Comments
a	**Label: Karbala**	**Go**	**No Go**	*Create & Name Map Preset*
b	**Loc: 38SMB 07669 07879**	**Go**	**No Go**	*Create & Name Map Preset*
c	**Zoom Level: Imagery**	**Go**	**No Go**	*Set Preset View*

Role Name Map – Fallujah Preset

Task 4 *Create Presets*				Comments
a	**Label: Fallujah**	**Go**	**No Go**	*Create & Name Map Preset*
b	**Loc: 38SLB 86788 91606**	**Go**	**No Go**	*Create & Name Map Preset*
c	**Zoom Level: Non-imagery**	**Go**	**No Go**	*Set Preset View*

Role Name Map – Baghdad/TAJI Preset

Task 5 *Division Boundary*				Comments
a	Graphic Control Measure: Boundary (XX)	Go	No Go	*Create Graphic*
	North Boundary			
b	Start/End Point: 38SMC 17756 03889 - 38SMC 63530 03607	Go	No Go	*Create Graphic*
c	Label: MND-C on No Gorth side	Go	No Go	*Name/Label Graphic*
d	Label: MND-B on Baghdad side	Go	No Go	*Name/Label Graphic*
	South Boundary			
e	Start/End Point: 38SMB 18407 72092 - 38SMB 64239 71375	Go	No Go	*Create Graphic*
f	Label: MND-B on Baghdad side	Go	No Go	*Name/Label Graphic*
g	Label: MND-S on South side	Go	No Go	*Name/Label Graphic*

Task 6 *Brigade Boundary*				Comments
a	Graphic Control Measure: Boundary (X)	Go	No Go	*Create Graphic*
b	Start/End Point: Followed River in center of Baghdad	Go	No Go	*Create Graphic*
c	Label: 1BCT on West side	Go	No Go	*Name/Label Graphic*
d	Label: 2BCT on East side	Go	No Go	*Name/Label Graphic*

Role Name Map – Baghdad/TAJI Preset

Task 7 *Battalion Boundary*				Comments
a	Graphic Control Measure: Boundary (ll)	Go	No Go	*Create Graphic*
	1BCT Boundary			
b	Start/End Point: 38SMB 18902 72555 - 38SMB 41510 89501	Go	No Go	*Create Graphic*
c	Label: 1-5 on West side	Go	No Go	*Name/Label Graphic*
d	Label: 1-8 on East side	Go	No Go	*Name/Label Graphic*
	2BCT Boundary			
e	Start/End Point: 38SMB 44732 87664 - 38SMC 62864 02618	Go	No Go	*Create Graphic*
f	Label: 2-5 on West side	Go	No Go	*Name/Label Graphic*
g	Label: 2-8 on East side	Go	No Go	*Name/Label Graphic*

Task 8 *Phase Line*				Comments
a	Graphic Control Measure: Phase Line	Go	No Go	*Create Graphic*
b	Start/End Point: 38SMB 15467 88205, 38SMB 65462 88311	Go	No Go	*Create Graphic*
c	Color: Red	Go	No Go	*Create Graphic*
d	Label: PL Red (Check for duplicate label on 3D map, ex: PL PL Red.)	Go	No Go	*Name/Label Graphic*

Role Name Map – Baghdad/TAJI Preset

Task 9 *Create Units*				Comments
a	Label: 1BCT	Go	No Go	*Create Unit*
b	Loc: 38SMB 29362 94788	Go	No Go	*Create Unit*
c	Type: Infantry Mech	Go	No Go	*Create Unit*
d	Echelon: Brigade	Go	No Go	*Create Unit*
e	Label: 1-5	Go	No Go	*Create Unit*
f	Loc: 38SMB 23144 83843	Go	No Go	*Create Unit*
g	Type: Infantry Mech	Go	No Go	*Create Unit*
h	Echelon: Battalion	Go	No Go	*Create Unit*
i	Label: 1-8	Go	No Go	*Create Unit*
j	Loc: 38SMB 37291 78122	Go	No Go	*Create Unit*
k	Type: Armor	Go	No Go	*Create Unit*
l	Echelon: Battalion	Go	No Go	*Create Unit*
m	Label: 2 BCT	Go	No Go	*Create Unit*
n	Loc: 38SMC 42900 00402	Go	No Go	*Create Unit*
o	Type: Armor	Go	No Go	*Create Unit*
p	Echelon: Brigade	Go	No Go	*Create Unit*
q	Label: 2-5	Go	No Go	*Create Unit*
r	Loc: 38SMB 51253 98290	Go	No Go	*Create Unit*
s	Type: Armor	Go	No Go	*Create Unit*
t	Echelon: Battalion	Go	No Go	*Create Unit*
u	Label: 2-8	Go	No Go	*Create Unit*
v	Loc: 38SMB 54339 85382	Go	No Go	*Create Unit*
w	Type: Infantry Mech	Go	No Go	*Create Unit*
x	Echelon: Battalion	Go	No Go	*Create Unit*

Role Name Map – Baghdad/TAJI Preset

Task 10 *Create Effort*				Comments
a	Label: Boundaries and Phase Lines	Go	No Go	*Create, Name,& Place Effort*
b	Elements: Boundaries & Phase lines	Go	No Go	*Create, Name,& Place Effort*
c	BDE/BN Units	Go	No Go	*Populate Effort*
d	Dropped in Effort List	Go	No Go	*Locate Product*

Task 11 *Create Effort*				Comments
a	Label: BDE/BN Units	Go	No Go	*Create, Name,& Place Effort*
b	Elements: 1BCT	Go	No Go	*Create, Name,& Place Effort*
c	1-5 BN	Go	No Go	*Populate Effort*
d	1-8 BN	Go	No Go	*Populate Effort*
e	2BCT	Go	No Go	*Populate Effort*
f	2-5 BN	Go	No Go	*Populate Effort*
g	2-8 BN	Go	No Go	*Populate Effort*
h	Dropped in Effort List	Go	No Go	*Locate Product*

Role Name Map – Fallujah Preset on the 3D Map

Task 12 *Create Air Path*				Comments
a	Graphic Control Measure: Air Path	Go	No Go	*Not scored in retention test*
b	Add Stickie with distance	Go	No Go	*Not scored in retention test*
c	Distance: ~75km	Go	No Go	*Not scored in retention test*

Task 13 Create Blue Assertion				Comments
a	Blue Assertion on map?	Go	No Go	*Not scored in retention test*
b	Label: 2-82	Go	No Go	*Not scored in retention test*
c	Type: Field Artillery	Go	No Go	*Not scored in retention test*
d	Echelon: Battalion	Go	No Go	*Not scored in retention test*

Task 14 *Create Red Event*				Comments
a	Red Event on map?	Go	No Go	*Not scored in retention test*
b	Label: Red	Go	No Go	*Not scored in retention test*
c	Type: Kidnapping CNN Reporter	Go	No Go	*Not scored in retention test*
d	Affiliation: Hostile	Go	No Go	*Not scored in retention test*

Task 15 *Create Distance Tool*				Comments
a	Displayed on Map	Go	No Go	*Not scored in retention test*

Role Name Map – Fallujah Preset on the 3D Map

Task 16 *Create Effort*				Comments
a	Label: 3D Map PE	Go	No Go	*Create, Name,& Place Effort*
b	Elements: Air Path	Go	No Go	*Create, Name,& Place Effort*
c	Stickie w/distance	Go	No Go	*Populate Effort / Create Stickie*
d	Blue Assertion	Go	No Go	*Populate Effort*
e	Red event	Go	No Go	*Populate Effort*
f	Distance Tool	Go	No Go	*Populate Effort*
g	Dropped in Effort List	Go	No Go	*Locate Product*

Role Name Map – Mosul Preset

Task 17 *Create Events*				Comments
a	Type: SAF	Go	No Go	*Create Event*
b	Title	Go	No Go	*Create Event*
c	Unit: 1-5 CAV Patrol	Go	No Go	*Create Event*
d	Loc: ivo 38SM B341 08770	Go	No Go	*Set Event Properties*
e	Comments: Patrol was attacked w/ 4 rounds SAF. No Go injuries and No Go damages reported.	Go	No Go	*Set Event Properties*
f	Type: IED	Go	No Go	*Create Event*
g	Title	Go	No Go	*Create Event*
h	Unit: D/1-9 CAV	Go	No Go	*Create Event*
i	Loc: ivo 38SM B383 06040	Go	No Go	*Set Event Properties*
j	Comments: 1 X WIA and 1 x disabled M1025	Go	No Go	*Set Event Properties*

Role Name Map – Mosul Preset

Task 18 *Edit Graphics*				Comments
a	Add a Division Boundary	Go	No Go	*Create Graphic*
b	Graphic Control Measure: Boundary (XX)	Go	No Go	*Create Graphic*
c	Label: ASR	Go	No Go	*Name/Label Graphic*
d	Graphic Control Measure: ASR/MSR	Go	No Go	*Name/Label Graphic*
e	Loc: Any road on preset	Go	No Go	*Locate Product*

Task 19 *Create Effort*				Comments
a	Label: Mosul Graphics	Go	No Go	*Create, Name,& Place Effort*
b	Elements: SAF Event	Go	No Go	*Create, Name,& Place Effort*
c	IED Event	Go	No Go	*Populate Effort*
d	Division Boundary	Go	No Go	*Populate Effort*
e	ASR Graphic	Go	No Go	*Populate Effort*

Overlay PE Pasteboard – Role Name BTL CPT WS Pasteboard

Task 20 *Create Pasteboard*				Comments
a	Name: Role Name BTL CPT WS	Go	No Go	*Create and Name Pasteboard*
b	Nested on Pasteboard	Go	No Go	*Create and Name Pasteboard*
c	Map nested	Go	No Go	*Create, Name, & Nest Map*
d	Map privileges set to any User Role No Got in CPOF Class	Go	No Go	*Set Privileges*
e	Annex_C_BDE_FRAGO_01-07	Go	No Go	*PASS: import & display product*
f	MND_I_ANNEXC	Go	No Go	*PASS: import & display product*
g	Auto Layout	Go	No Go	*Set Automatic Layout*

Overlay PE Pasteboard – Role Name BTL CPT COP Pasteboard

Task 21 *Create Pasteboard*				Comments
a	Name: Role Name BTL CPT COP	Go	No Go	*Create and Name Pasteboard*
b	Nested on Pasteboard	Go	No Go	*Create and Name Pasteboard*
c	Map nested	Go	No Go	*Create, Name, & Nest Map*
d	Pasteboard privileges set to any User Role No Got in CPOF Class	Go	No Go	*Set Privileges*
e	1BCT_Ethnicity	Go	No Go	*PASS: import & display product*
f	CORPxANNEXIxMSR	Go	No Go	*PASS: import & display product*
g	Auto Layout	Go	No Go	*Set Automatic Layout*
h	Blue SA Effort on Map	Go	No Go	*Locate Product*
i	Activated Current PLI	Go	No Go	*PASS: import & display product*

Overlay PE Pasteboard

Task 22 *Nesting and Layouts*				Comments
a	**Master Schedule**	**Go**	**No Go**	*Create Master Schedule*
b	**Nested**	**Go**	**No Go**	*Create Master Schedule*
c	**Event Table**	**Go**	**No Go**	*Set Event Table Properties*
d	**Nested**	**Go**	**No Go**	*Set Event Table Properties*
e	**Table**	**Go**	**No Go**	***Not scored in retention test***
f	**Nested**	**Go**	**No Go**	*Set Event Table Properties*
g	**Auto Layout**	**Go**	**No Go**	*Set Automatic Layout*

Overlay PE Pasteboard

Task 23 *Import Digital Photo*				Comments
a	**Image Pasteboard Nested on Overlay PE Pasteboard**	**Go**	**No Go**	*Create and Name Pasteboard*
b	**Display Image**	**Go**	**No Go**	***Not scored in retention test***
c	**Nested**	**Go**	**No Go**	***Not scored in retention test***

APPENDIX C

DEMOGRAPHIC QUESTIONNAIRE

FOR OFFICE USE ONLY	
Date	
PE	
ID	

Demographic Information for CPOF Skill Retention

General Instructions: These items deal with your experience with digital systems. Please respond to each item as carefully as you can. If you have questions, please feel free to ask the researcher.

1. What is your current **grade/rank**?

E1 (PV1)	☐
E2 (PV2)	☐
E3 (PFC)	☐
E4 (SPC/CPL)	☐
E5 (SGT)	☐
E6 (SSG)	☐
E7 (SFC)	☐
E8 (MSG/1SG)	☐
E9 (SGM/CSM)	☐
O1/O2 (LT)	☐
O3 (CPT)	☐
O4 (MAJ)	☐
O5 (LTC)	☐

2. What is your **MOS** (enlisted) / **branch** (officer)? _____

3. What is your current **duty position**? _____

4. What is your total **time in service (TIS)**? _____

5. If you have **staff experience** in a Tactical Operations Center (TOC) or a Command Post (CP) at any level, complete Item 5. If not, check here _____ and continue to the **next page**.

5a) Which **section/element** of the staff were you assigned? **CHECK ALL THAT APPLY.**

S/G-2 (Intelligence)	☐
S/G-3 (Current Operations)	☐
S/G-3 (Future Operations)	☐
S/G-4/1 (Sustainment Operations)	☐
S/G-5 (Civil Military Operations)	☐
S/G-6 (C4 Operations)	☐
S/G-7 (Information Operations)	☐

5b) Which **echelon** were you assigned? **CHECK ALL THAT APPLY.**

Division	☐
Brigade	☐
Battalion	☐
Company	☐

5c) What was your **duty position** within the TOC/CP? **LIST ANY THAT APPLY.**

_____

_____

_____

_____

_____

_____

_____

6. Which of the following **courses** have you completed? **CHECK ALL THAT APPLY.**

ANCOC	☐
U.S. Army Sergeants Major Academy (USASMA)	☐
Battle Staff NCO Course	☐
Maneuver Captain's Career Course (MC3)	☐
Intermediate Level Education (ILE)	☐
School of Advanced Military Studies (SAMS)	☐
None	☐

7. Which type of experience do you have **using personal computers**? **CHECK ALL THAT APPLY.**

Used application software (e.g. Outlook, PowerPoint, games)	☐
Installed application software	☐
Installed software patches	☐
Installed Hardware (e.g. hard drive, graphics card)	☐
Changed boot-up options or BIOS settings	☐
Authored web pages	☐
Authored programs	☐
Never used a personal computer before	☐

8. Which **personal computer applications** have you used? **CHECK ALL THAT APPLY.**

Word Processing (e.g., Microsoft Word, WordPerfect)	☐
Spreadsheet/Database (e.g., Excel, Lotus 1-2-3, Access)	☐
Presentations (e.g., PowerPoint, Keynote, Adobe Acrobat)	☐
Graphics (e.g., MS Paintbrush, Autocad)	☐
Layout (e.g., Page Maker, Adobe Dreamweaver)	☐
Digital Photo Editing (e.g., Kodak Easyshare, Adobe 8)	☐
None	☐

9. Overall, how would you **rate your proficiency** on each of the following digital systems?

> **Basic**- You can use the system to perform a limited set of functions but there are many aspects of the system with which you are unfamiliar.
> **Medium**- You are comfortable with the system and are knowledgeable about most of its functions and quirks. You have limited troubleshooting abilities.
> **High**- You have advanced knowledge of this system and can troubleshoot many problems. You frequently are asked to help others who have difficulty with the system.

Check the appropriate box for **each** digital system.

System	Never Used	Basic	Medium	High
FBCB2	☐	☐	☐	☐
ASAS	☐	☐	☐	☐
MCS	☐	☐	☐	☐
AFATDS	☐	☐	☐	☐
CPOF	☐	☐	☐	☐

10. Prior to attending the CPOF Course, which **formal individual system training** did you receive for **each** of the following digital systems? **CHECK ALL THAT APPLY.**

	FBCB2	ASAS	MCS	AFATDS	CPOF
No Formal Training					
Online Course (self study)					
Familiarization training in a classroom (typically 1-3 days of training)					
Operator Course besides this CPOF course (typically 5 or more days of training)					
NET Training					
NET Delta Training (trained on changes and upgrades)					
Digital Master Trainer Course					
Other:_____					

11. Prior to attending the CPOF Course, which types of **unit collective training** did you receive for **each** of the following digital systems? **CHECK ALL THAT APPLY.**

	FBCB2	ASAS	MCS	AFATDS	CPOF
No Unit Collective Training					
Motorpool training					
FTX at home station or CTC					
CPX at home station or CTC					
Other:_____					

12. Which of the following **Digital/Satellite Topography Systems** have you used?
CHECK ALL THAT APPLY.

Digital Topography Support System (DTSS)	☐
Terrabase	☐
Falcon View	☐
Google Earth	☐
None	☐

13. Which of the following **Air Defense/Airspace Management Systems** have you used?
CHECK ALL THAT APPLY.

Air and Missile Defense Planning and Control System (AMDPCS)	☐
Air Missile Defense Warning System (AMDWS)	☐
Tactical Airspace Integration System (TAIS)	☐
None	☐

14. At this time, which **duty position/role** would you most likely use CPOF in an operational setting?

I probably would not use CPOF at all	☐
Primary Operator for a Staff Section/Element	☐
Staff Officer / NCO in BN or BDE TOC	☐
BN/BDE/CO Commander	☐

15. If you used **CPOF** while deployed on a combat tour, please complete the following for your **Most Recent Combat Experience**. If not, check here _____ and continue to Item 16.

Combat Theater	
Iraq (OIF)	☐
Afghanistan (OEF)	☐
Kosovo	☐
Other	☐

Duty position(s) or role(s) when using this system. (mark all that apply)	
Primary Operator for a Staff Section/Element	☐
Staff Officer / NCO in BN or BDE TOC	☐
BN/BDE Commander	☐

Number of months you used CPOF during tour.	
1-6 months	☐
7-12 months	☐
13-18 months	☐
19+ months	☐

16. If you used **FBCB2** while deployed on a combat tour, please complete the following for your **Most Recent Combat Experience**. If not, check here _____ and continue to Item 17.

Combat Theater	
Iraq (OIF)	☐
Afghanistan (OEF)	☐
Kosovo	☐
Other	☐

Duty position(s) or role(s) when using this system. (mark all that apply)	
Primary Operator for a Leader	☐
Section Ldr? Squad Ldr	☐
Vehicle Cdr (other than Ldr/Cdr)	☐
PLT Ldr / PSG	☐
Co Hqs or support element	☐
Co Cdr / Troop CDR / 1SG	☐
Staff Officer / NCO	☐

Number of months you used FBCB2 during tour.	
1-6 months	☐
7-12 months	☐
13-18 months	☐
19+ months	☐

17. If you used **ASAS** while deployed on a combat tour, please complete the following for your **Most Recent Combat Experience**. If not, check here _____ and continue to Item 18.

Combat Theater	
Iraq (OIF)	☐
Afghanistan (OEF)	☐
Kosovo	☐
Other	☐

Duty position(s) or role(s) when using this system. (mark all that apply)	
Primary Operator for an Intelligence Staff/Section/Element	☐
Staff Officer / NCO	☐

Number of months you used ASAS during tour.	
1-6 months	☐
7-12 months	☐
13-18 months	☐
19+ months	☐

18. If you used **AFATDS** while deployed on a combat tour, please complete the following for your **Most Recent Combat Experience**. If not, check here _____ and continue to Item 19.

Combat Theater	
Iraq (OIF)	☐
Afghanistan (OEF)	☐
Kosovo	☐
Other	☐

Duty position(s) or role(s) when using this system. (mark all that apply)	
Primary Operator for a Fire Support Element (FSE)	☐
Section Leader	☐
Battery HQ or support element	☐
Battery CDR / 1SG	☐
Staff Officer / NCO	☐

Number of months you used AFATDS during tour.	
1-6 months	☐
7-12 months	☐
13-18 months	☐
19+ months	☐

19. If you used **MCS** while deployed on a combat tour, please complete the following for your **Most Recent Combat Experience**. If not, check here _____.

Combat Theater	
Iraq (OIF)	☐
Afghanistan (OEF)	☐
Kosovo	☐
Other	☐

Duty position(s) or role(s) when using this system. (mark all that apply)	
Primary Operator for a Staff Section/Element	☐
Co HQ or support element	☐
Co CDR / Troop CDR / 1SG	☐
Staff Officer / NCO	☐

Number of months you used MCS during tour.	
1-6 months	☐
7-12 months	☐
13-18 months	☐
19+ months	☐

Survey is complete. Please return form to researcher.

APPENDIX D

RETENTION QUESTIONNAIRE

FOR OFFICE USE ONLY	
Date	
PE	RETENTION
ID	

CPOF Training Questionnaire

General Instructions: These items deal with your experience with digital systems **since you've completed CPOF training at BCTC**. Please respond to each item as carefully as you can and remember to only include information **since your CPOF training BCTC**. If you have questions, please feel free to ask the researcher.

1. Please indicate your current **rank/grade** below.

E1 (PV1)	☐
E2 (PV2)	☐
E3 (PFC)	☐
E4 (SPC/CPL)	☐
E5 (SGT)	☐
E6 (SSG)	☐
E7 (SFC)	☐
E8 (MSG/1SG)	☐
E9 (SGM/CSM)	☐
O1/O2 (LT)	☐
O3 (CPT)	☐
O4 (MAJ)	☐
O5 (LTC)	☐

2. Have you changed your **MOS** (enlisted) / **branch** (officer) since completing the CPOF training at BCTC? If so, please indicate your new MOS below.

   _____

3. Have you changed your **duty position** since completing the CPOF training at BCTC? If so, please indicate your new duty position below.

   _____

4. If you have any **new staff experience** in a TAC, TOC, or CP at any level since completing the CPOF training at BCTC, complete Item 4. If not, check here _____ and continue to the **next page**.

4a) What **section/element** is your new staff experience? **CHECK ALL THAT APPLY.**

S/G-2 (Intelligence)	☐
S/G-3 (Current Operations)	☐
S/G-3 (Future Operations)	☐
S/G-4/1 (Sustainment Operations)	☐
S/G-5 (Civil Military Operations)	☐
S/G-6 (C4 Operations)	☐
S/G-7 (Information Operations)	☐

4b) What **echelon** is your new staff experience? **CHECK ALL THAT APPLY.**

Corps	☐
Division	☐
Brigade	☐
Battalion	☐
Company	☐

4c) What is your new **duty position** within the TAC/TOC/CP?
LIST ANY THAT APPLY.

_____

_____

_____

_____

_____

_____

_____

5. Since attending the CPOF Course at BCTC, did you receive any **formal individual-system training** on the following digital systems? If so, indicate the system and type of training below. **CHECK ALL THAT APPLY.**

	FBCB2	ASAS	MCS	AFATDS
No Formal Training				
Online Course (self study)				
Familiarization training in a classroom (typically 1-3 days of training)				
Operator Course besides this CPOF course (typically 5 or more days of training)				
NET Training				
NET Delta Training (trained on changes and upgrades)				
Digital Master Trainer Course				
Other:_____				

6. Since attending the CPOF Course at BCTC, did you receive any **unit collective training** on the following digital systems? If so, indicate the system and type of training below. **CHECK ALL THAT APPLY.**

	FBCB2	ASAS	MCS	AFATDS
No Unit Collective Training				
Motorpool training				
FTX at home station or CTC				
CPX at home station or CTC				
Other:_____				

7. Since completing your CPOF training at BCTC, did you participate in a **Field Training Exercise** (FTX) in which **CPOF was used**? If not, check here _____ and continue to Item 8.

7a) Indicate how **you** used CPOF during the FTX. **CHECK ALL THAT APPLY.**

Saw CPOF being used	☐
Attended or participated in BUB/CUB	☐
Constructed or helped construct a BUB/CUB	☐
Primary Operator in a TOC/CP	☐
Battle CPT/ Battle NCO	☐
S2	☐
Future Operations cell	☐
Other	☐

8. Since completing your CPOF training at BCTC, did you participate in a **Command Post Exercise** (CPX) in which **CPOF was used**? If not, check here _____ and continue to Item 9.

   8a) Indicate how **you** used CPOF during the CPX. **CHECK ALL THAT APPLY.**

Saw CPOF being used	☐
Attended or participated in BUB/CUB	☐
Constructed or helped construct a BUB/CUB	☐
Primary Operator in a TOC/CP	☐
Battle CPT/ Battle NCO	☐
S2	☐
Future Operations Cell	☐
Other	☐

9. Since completing your CPOF training at BCTC, how often did you use CPOF?

Never	☐
Once or twice	☐
A few times	☐
At least once a week	☐
Daily	☐

10. Overall, how would you **rate your proficiency** on CPOF at this point?

Poor	Low	Good	High
☐	☐	☐	☐

Survey is complete. Please return form to researcher.